Eskom	Report	Generation Engineering

Title: **Scope of work for the installation of elevated drains at the ash dam**

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FIGURES

1. INTRODUCTION

Duvha produces wet ash slurry that gets pumped to the Ash Dam. Ash settles and water is decanted to the low-level Ash water return dam (LLAWRD) from where it gets pumped to the High-Level Ash Water Return Dam (HLAWRD) then back to the station for reuse for further ashing.

The V-section of the ash dam facility has high seepage which is causing saturation at the toe of the dam. It is required that elevated drains shall be constructed to intercept the seepage from the dam and channel it to the solution trench.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the scope of work for the installation of the elevated drains to collect seepage on the V-section of the ash dam which will lower phreatic levels and improve the dam stability.

2.1.1 Purpose

The purpose of this project is to appoint a Contractor to install the elevated drains at the V-section of the ash dam to collect seepage and improve the stability of this section.

2.1.2 Applicability

This document applies to Duvha Power Station only.

2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] 240-99527377 - Inspection Manual for Civil Works at Eskom's Power Stations

[3] ENM0003 – Ash Dams Operations and Maintenance Manual

[4] Occupational Health and Safety Act No. 85 of 1993,

[5] SANS 10286 – Management of Mine Residue

[6] SANS 1200 AA General (Small works)

[7] SANS 1200 DB Earthworks (including Ash)

[8] SANS 1200 GA Concrete (Small works)

[9] SANS 1200 LB Bedding (Pipes)

[10] SANS 5862-1 Concrete tests — Consistence of freshly mixed concrete — Slump test

[11] 0.57/64408 Ash dam elevated drains additional pipe installation plan layout

[12] 0.57/64409 SHT 01 Ash dam elevated drains additional pipe installation details 1 of 2

[13] 0.57/6409 SHT 02 Ash dam elevated drains additional pipe installation details 2 of 2

[14] 0.57/6409 SHT 02 Ash dam elevated drains additional pipe installation details 3 of 3

[15] 0.57/64410 Ash dam elevated drains additional pipe installation penstock connector box details

2.2.2 Informative

[16] National Water Act, (Act 36 of 1998)

[17] National Environmental Management Act, (Act 107 of 1998)

2.3 DEFINITIONS

2.3.1 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
CPTu	Piezo Cone Penetration Testing
ROC	Required Operational Capability
SANS	South African National Standards
SRD	Stakeholder Requirements Definition
SRD	Stakeholders Requirements Definition

2.5 ROLES AND RESPONSIBILITIES

a) **System Engineer (SE):** It is the role of the System Engineer to ensure that this scope is executed accordingly, ensure all the work is done as per specification and ensure the quality of the works executed.

b) **Project Manager (PM):** It is the role of the *Project Manager* is to manage the project and ensure all works are being executed with accordance to the contract agreement between the client and the appointed contractor within the timeframe stipulated on the contract.

2.6 PROCESS FOR MONITORING

This will follow an Eskom internal review process.

3. SCOPE OF WORK

3.1 OVERVIEW

The Stability assessment report, 2020 Ash Dam Stability Analysis Report (SAWE Report No. P047-R0047 dated 14 December 2020), based on the high phreatic levels and post liquefaction analysis recommended an intervention to mitigate failure of the embankment. The following abstract has reference:

“On the post liquefaction analysis, Sections H and I (at the V-section) do show some of the slip circles below the 1.1 but the average is on the requirement. Sections H and I on the northern flank also indicate some intermediate (bottom section of slope) slip circles below the requirement which is clearly visible on site with the high rate of seepage at the toe of these sections. This could cause instability on the long run as the material on the toe is slowly washed away by the constant channelling.

The solution to the high rate of seepage which is affecting the dam stability was the installation of elevated drains to collect the seepage on this area and discharge it to the solution trench. The aim of the elevated drains is to collect seepage which will decrease saturation of this area and therefore lower the phreatic levels.

3.2 SITE CHARACTERISTICS

The ash dam is a hydraulically deposited tailings facility. The ash slurry is deposited to the ash dam via the ash and sludge pipelines which terminate at the ash dam distribution box. Water is decanted from the Ash Dam, via penstocks, and to a concrete lined channel along the toe line. This water is channelled to the silt traps before flowing into the AWR (Ash Water Return) Dam. Water is then pumped back to the plant from the AWR Dam for re-use in the ash hydraulic deposition process.

The specific V-section is situated at the Eskom Duvha Power Station Ash Dam Complex, about 13 kilometres south-east of Emalahleni in the Nkangala District, Mpumalanga Province. Figure 1 below shows the V-section. The centre co-ordinates (WGS 84) for the proposed buttress at the V-section are: Latitude **25° 56’ 00.75’’ S** and Longitude **29° 20’ 41.69’’ E**

Figure 1: V-section

3.3 DETAILED SCOPE

The contractor shall execute the scope of work to install the elevated drainpipe system as follows:

a) Clear and prepare area to be covered by the foundation bedding layer and seepage collector boxes. An area of approximately 570m² shall be cleared and prepared.

b) Construct a 1.5m-thick stone / rock base for free drainage purposes and to form a work bench on which the pipe drain can be installed.

c) Construct 600mm thick sand blanket filter on top of the constructed rock base. Sand to be compacted to 95% standard Proctor.

d) A4 bidim or similar approved by the Engineer are to be installed between the different rock bedding layers and the filter sand layer.

e) Construct two concrete seepage collector boxes. One box with a baffle wall to intercept the seepage from the old penstock which is the source of seepage on the V-section and another box to collect the seepage down slope of the V-section and discharge to the solution trenches.

f) Install the main pipe drainage system (3x 160mm diameter perforated drainpipes) to tie into the seepage collector box for the penstock and tie into the seepage collector box downslope of the V-section and ultimately the solution trenches.

g) Install two side drain collectors on the third (3rd) bench which consist of 110mm diameter perforated drainpipes covered by stone and geotextile to link up with main conveyance filter.

h) Install two side drain collectors on the second (2nd) bench which consist of 1x 110mm diameter perforated drainpipes covered by stone and geotextile to link up with main conveyance filter.

i) Landscape after construction to adhere to Environmental specifications and requirements.

3.3.1 DESIGN & MATERIALS REQUIREMENTS

3.3.1.1 Sand filter zone construction (Main filter)

A horizontal blanket and inclined blanket sand filter zone of 600mm thickness by 3m wide will be constructed on top of the rock bedding layers as described below. The sand zone will house the perforated drainpipes which will link up with the concrete seepage collector box. An A4 geotextile layer will be placed below the sand layer to separate the sand layer with the rock bedding layers beneath.

The sand grading envelope in figure 2 below provides the recommended upper and lower bands for the filter sand to be used.

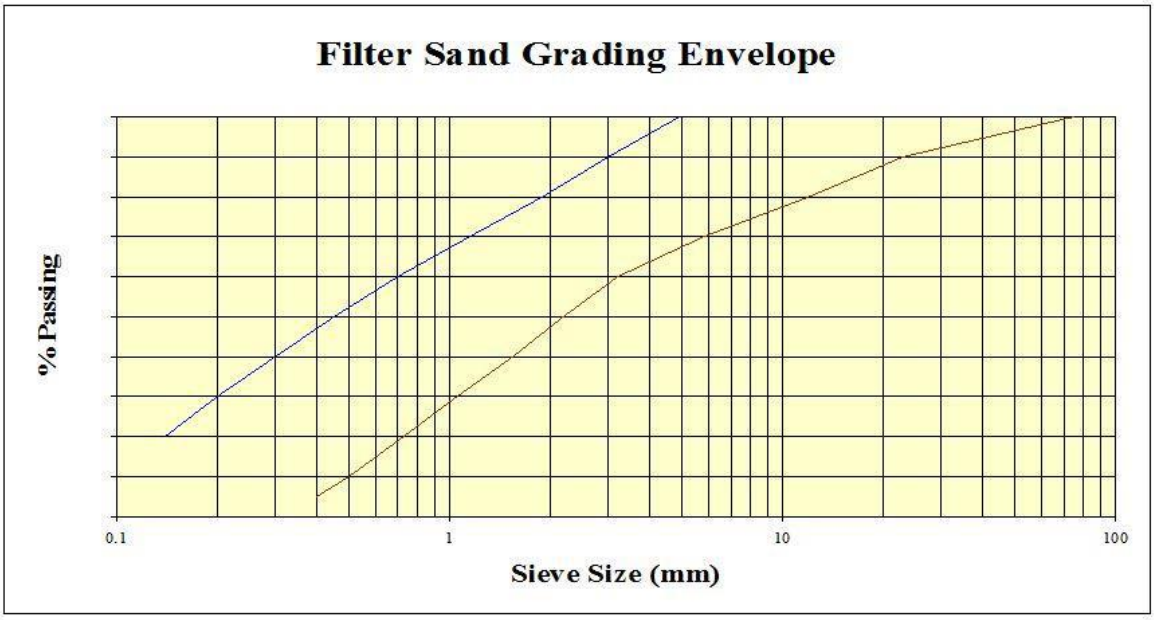

Figure 2: Sand grading envelope

3.3.1.2 Rock base foundation construction (Main filter)

Due to the wet conditions at the V-section due to constant seepage, a working platform will have to be constructed for the pipe drains.

The working platform shall:

1. Be semi free draining; and
2. Provide weight to consolidate the current wet base.

Considering the above criteria, it was decided to use a stone / rock base for the foundation platform construction as it will provides for semi free draining conditions underneath the pipe drain zone. The rock base will also add weight to the V-section to assist with stability.

The rock base shall consist of three (separate layers) as indicated on figure 3. The bottom base layer shall consist of rock with diameter >300mm and layer thickness of 500mm. The middle layer will have rock with diameters between 200mm and 300mm and layer thickness of 500mm, and the top layer will have rock / stone with diameter between 100mm and 200mm with layer thickness of 500mm.

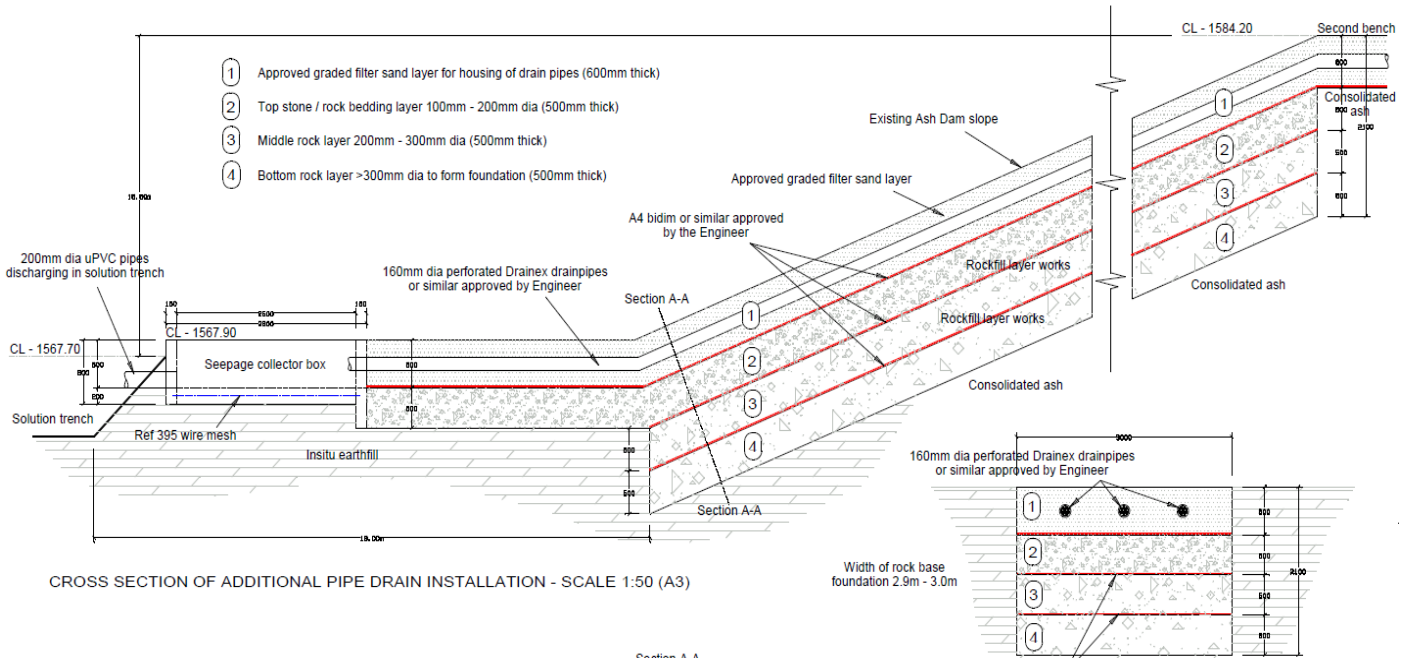

Figure 3: Base layers and main drainpipes

During construction, the rock material can be dumped from either side of the cleared V-section to form the base layers. This will ease construction conditions, especially in the V where the area is highly saturated. As the rock base is constructed the three (3) proposed layers shall be divided by A4 geotextile layers. This is to prevent the finer rock of the top layers mixing with the larger bottom rock sizes.

3.3.1.3 Main drainpipes and seepage collector boxes

A set of three (3) perforated Drainex drainpipes will be installed within the blanket sand filter zone, as discussed under section 3.3 (detailed scope). The pipes shall be 160mm diameter perforated drainage pipes (Drainex or similar approved) and shall be installed against the slope of the Ash Dam up to the third bench.

The perforated Drainex pipes start at the 3rd bench where they will link with the side drain collector pipes as shown in figure 4. The main drainpipes will also link with the side drain collector pipes at the 2nd bench (See figure 5) and link up with a newly constructed seepage collector box for the penstock as shown in figure 6. The drainpipes will exit the penstock seepage box and link up with the concrete seepage collector box next to the solution trench as per detail drawings 0.57/64408. Two pipes of 200mm diameter PVC will drain the collector box to the solution trenches (see figure 7).

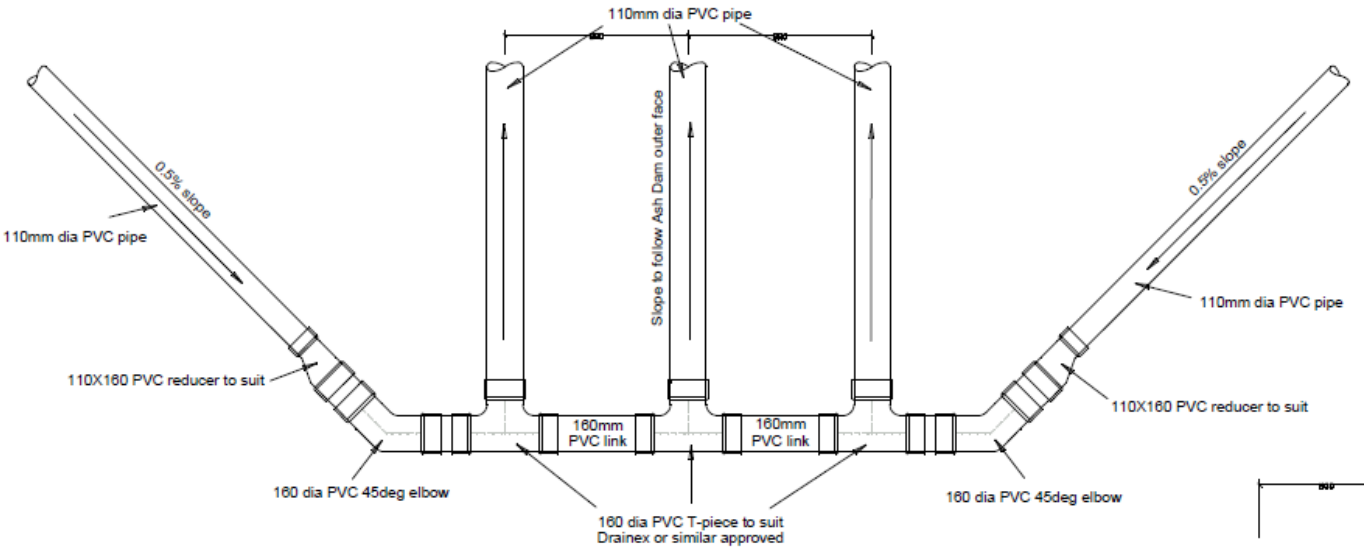

Figure 4: Main drainpipes linking with side drains on the 3rd bench.

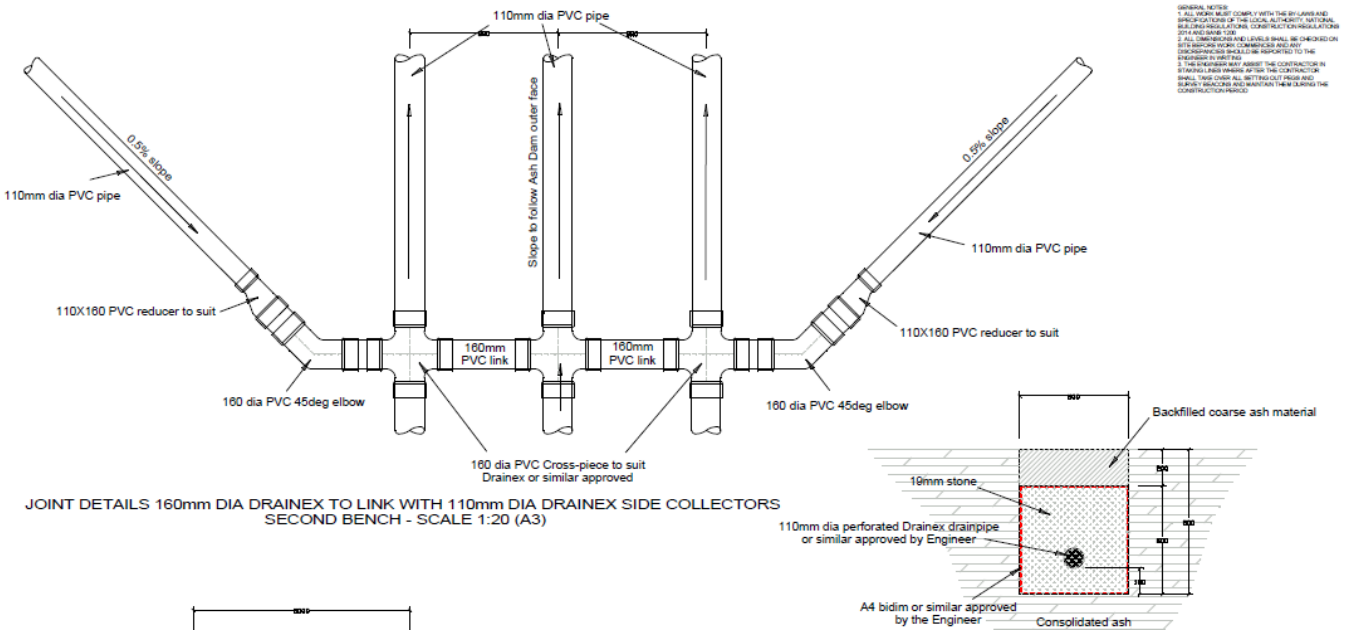

Figure 5: Side drains linking to the main drainpipes on the 2nd bench.

The seepage collector boxes shall be constructed with class 35/19MPa concrete and minimum cover of 75mm. The penstock seepage collector box shall be of dimensions 2000mm x 2000mm x 1500mm and the seepage collector box which will discharge into the solution trenches shall have dimensions of 2500mm x 2000mm x 800mm. Ref 395 Wire mesh shall be placed within the floor slab.

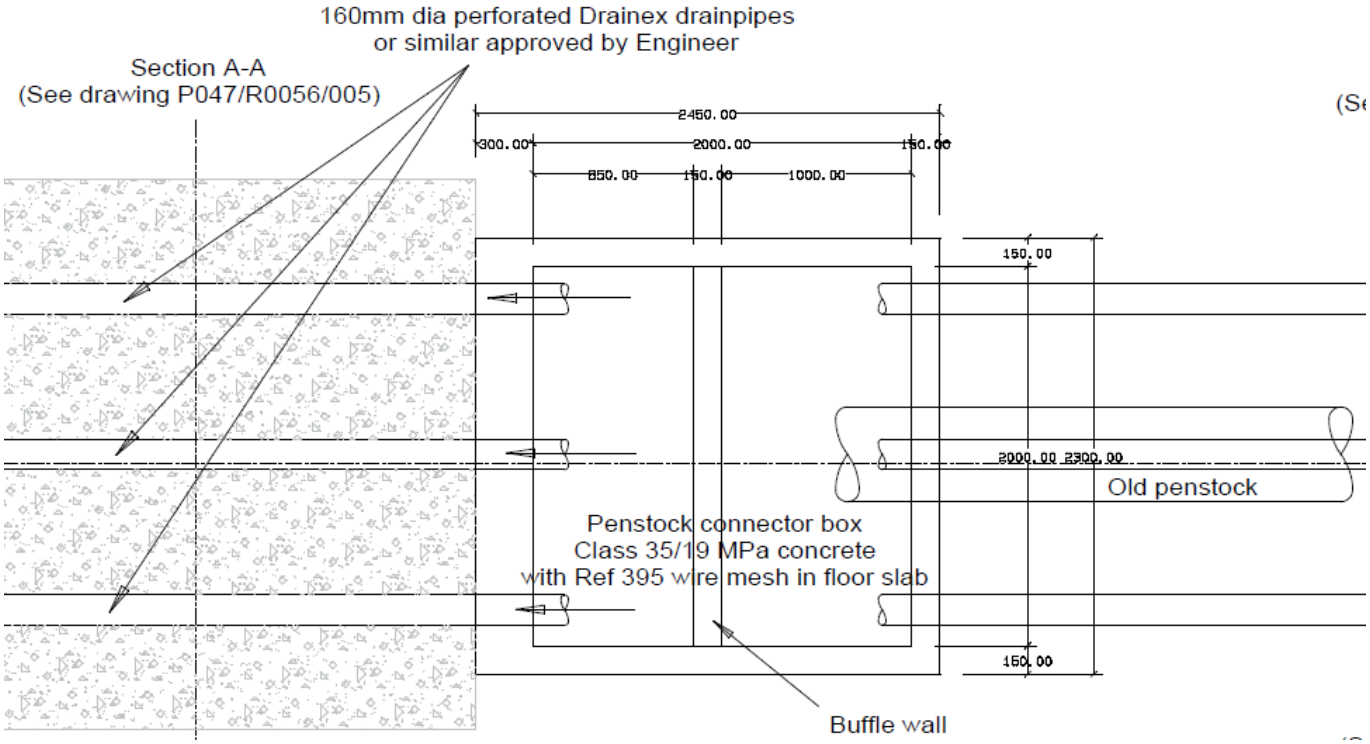

Figure 6: Seepage collector box for the penstock

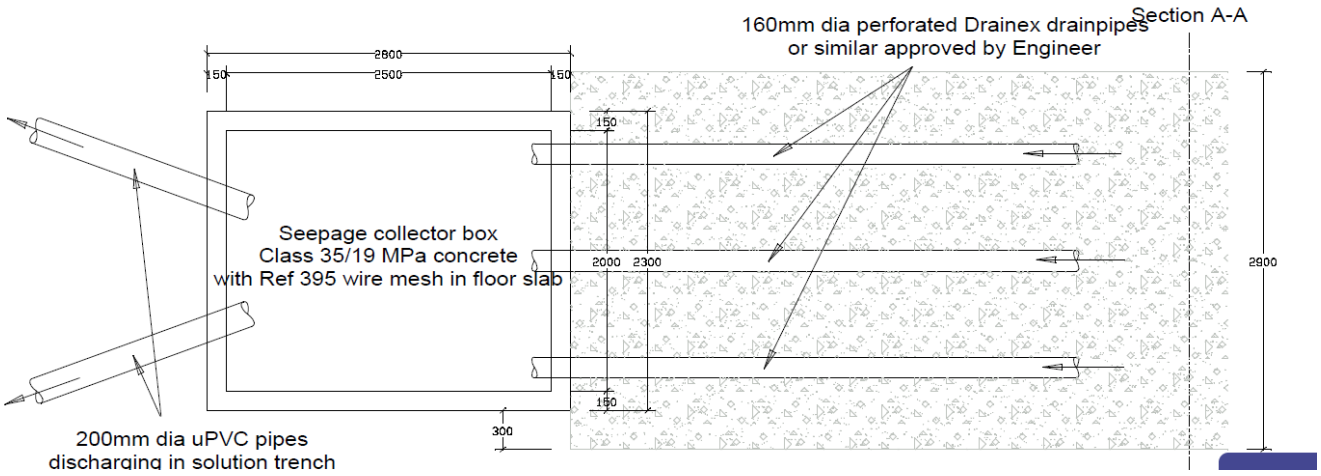

Figure 7: Seepage collector box discharging into the solution trench.

3.3.1.4 Side drains collectors

Two (2) side drain collectors will be installed on the third bench as well as the 2nd bench as shown in figures 4 and 5. These collectors will intercept seepage between piezometer lines “H” and “K” and will consist of 1x 110mm diameter perforated (Drainex or similar) drainpipes which will be covered by 19mm stone and A4 geotextile as per Detail Section C-C on the drawings. The two side collectors will link up with the main conveyance filter which will be constructed against the Ash Dam’s outer face. The collector drains will be installed with a 0.5% slope towards the main filter.

The detail design drawings have the required dimensions for the construction of the elevated drains at the ash dam. The contractor shall provide a method statement detailing the execution of all the works required as per this scope of work and detail design drawings provided.

3.4 GENERAL REQUIREMENTS

The Appointed Contractor shall be responsible for the construction of the works, including all temporary works, and all associated services and infrastructures in accordance with the detailed drawings and specifications provided by the Employer.

The Contractor disposes of all waste generated by the works into correct disposal waste bins as provided by the Project Manager for small waste, the Contractor(s) shall be responsible for disposing waste at approved disposal sites for waste that cannot be disposed on site. The Contractor takes all necessary precautions that may be required to safeguard existing infrastructure and services including protection of all surface works against the ingress of surface water. These additional works shall be formally documented in method statements for the Employer's review and acceptance. This includes detailed inspections and assessment, supply/procurement of material, construction and finishes.

The Contractor takes note that review and acceptance of any document/ drawing/ design calculations by the Employer's engineer in no way relieves the Contractor of his liability for the works. The Contractor remains liable for all works conducted as per this document. The Contractor is liable and fully accountable for the design and construction works as well as the constructability thereof.

The Contractor interacts with others through the Project Manager, to ensure seamless integration of the various works. Only trained personnel are allowed to perform the works of all infrastructure. Records of training are maintained by the Contractor's Quality Control Department.

3.4.1 Temporary works

The Contractor shall provide, operate, and maintain enough pumping equipment, well points, pipes and other equipment as may be necessary for dealing with water. The Contractor shall also provide any temporally works as may be necessary to minimise damage, inconvenience, or interference with the execution of works.

3.4.2 Site clearance

Site clearance shall include for the removal of any structure e.g., footpath paving, concrete slabs, signs, fencing and or barriers, pot plants etc.

Remove topsoil to nominal depth of 150mm haul and stockpile on designated stockpile area. The site shall be cleared up to a distance or at least 1m beyond the perimeter of the structure associated with the construction works. This operation shall be deemed to include the digging up and removal of rubbish, debris, vegetation, hedges, shrubs etc. as well as the digging up of topsoil to a depth of 150mm and examining for and removal of all dead roots and other vegetable matter likely to provide food for termites.

All excess topsoil material together with the rubbish, debris, vegetation, hedges, shrubs etc. shall be removed after completion of the works. The material shall be loaded and hauled to a designated approved disposal site of the Contractor's choice where it shall be dumped. The construction areas shall be kept in a dry and acceptable condition in all weather conditions.

3.4.3 Excavations

Trenches and holes for foundations and bases shall be excavated to the several lengths, widths and depths shown on drawings provided. Bottoms of trenches and holes shall be level, with sides trimmed vertical for the full width from top to bottom. Any excavations taken out too deep shall be made up to

correct levels with Class A concrete, at the Contractor's expense. Back filling and ramming is not acceptable. Excavated ash material may be used for backfilling in all areas.

3.4.4 Water in Excavations:

- The area on which the elevated drains shall be installed or constructed is a saturated area with constant flow of water (seepage) from the dam. The Contractor shall be required to properly deal with water and dispose of water to ensure that the works are kept sufficiently dry for their proper execution while adhering to environmental regulations.
- The Contractor shall provide, operate, and maintain enough quantity of the pumping equipment, well points, pipes and other equipment that may be necessary to deal with water.
- The Contractor shall also provide temporally works as may be necessary to minimise damage, inconvenience, or interference.
- No water shall be allowed to accumulate in any portion of the excavations. Any water found in the excavations shall immediately be removed by pumping, the contractor shall propose a method of water removal prior to execution should they believe that pumping will be ineffective. It is the Contractor's responsibility to keep excavations water free and the Contractor must supply all pumps and all equipment that may be necessary for clearing out the water. Water must be cleared in such a way that it cannot seep or flow back into the excavations.

3.4.5 Fresh concrete

- The concrete should be designed to ensure adequate consistence as measured by the slump test (see SANS 5862-1). The required slump shall be 100 mm.
- The concrete should be cohesive enough to ensure complete compaction and to avoid segregation. This can be assessed by tapping the base plate in the slump test after the slump has been determined. A cohesive mix should settle gradually without the concrete falling apart.
- The bleeding of the fresh concrete should be minimized as excessive bleeding can result in zones of weakness when trapped below aggregate particles and reinforcing steel and also interfere with finishing operations. Care shall be taken not to reduce bleeding too much as this will significantly increase the risk of plastic shrinkage cracking.
- The effect of admixtures, when used, on setting and bleeding should be assessed.
- The amount of paste on the surface after compaction should be assessed in the laboratory. Too little paste could result in difficulty in finishing the surface and disturbance of the coarse aggregate near the surface. Too much paste could result in durability problems such as dusting and crazing of the surface of the floor.
- Concrete should be thoroughly compacted in terms of SANS 10100 /2 by using suitable concrete vibrators.
- Damp curing of the topping should start immediately after surface finishing by covering the patch with polyurethane or damp hessian. Damp curing should be maintained for at least 3 days.
- The construction area is to be barricaded for at least 3 days.

NB: All construction specifications shall be provided by the contractor for review and acceptance to the employer’s engineer prior to execution.

3.4.6 Finishes:

Finishes shall be a smooth power float finish.

3.4.7 Hardened concrete

The 28-day compressive strength for concrete is 35MPa.

3.4.8 Formwork

All formwork to be provided with a smooth finish.

All exposed concrete edges to be provided with a 25 x 25 chamfer. Contractor to liaise with the Engineer in this regard.

3.4.9 Reinforcement

- All reinforcement shall be Ref 395 welded mesh reinforcement.
- All reinforcement to be thoroughly cleaned from any rust, shale, or contaminations e.g., oil.

3.4.10 Site to be left clear.

The Contractor shall be responsible for the clearing away of excess materials, debris, and rubbish, arising from the construction of the Works, during the construction and maintenance periods.

On completion of the Permanent Works the Contractor shall, at his expense, remove all surplus materials and equipment save that required for maintenance work, which shall be removed on completion of the whole of the Works. However, no guards or safety equipment provided in terms of the “Occupational Health and Safety Act, 1993” for securing the safety of persons may be removed if such removal constitutes a reduction to the safety of persons.

3.5 QUALITY CONTROL

All work is carried out under the supervision of an experienced supervisor. The Contractor complies with the Employer’s Quality Requirements as specified in Eskom Generation Standard GGS 0462.

All work must be inspected and approved as per QCP holding points by the system engineer and project manager. The contractor’s supervisor is entirely responsible for ensuring that the work is carried out as per the complete QCP.

All quality control documentation is submitted to the Project Manager within 7 days of Contract date. Quality Control:

- The contractor to provide a Quality Control Plan to Eskom Duvha for approval prior to construction. The contractor shall also assure that the following quality control documentation are available during construction and are submitted to ESKOM on completion.
- Ready Mix Concrete delivery note (if ready mix concrete will be used)
- QCP plan with signed off witness and hold points by Eskom’s Engineer
- Slump test to be done in terms of SANS 5862-1
- Cube Testing in terms of SANS 5860, SANS 5860 – 2&3:
- Cube test samples to be taken and tested by an approved laboratory which will be agreed upon prior to execution of work.
- Testing of cubes shall be done on 7 and 14 as well as 28 days.

The construction area must be rehabilitated post construction to prevent erosion and adhere to environmental requirements.

3.6 SKILLS & EXPERIENCE

The works shall be carried out under the supervision of the contractor's Engineer. The final report shall be signed and approved by the responsible Professional Engineer.

3.7 GOVERNANCE

As a minimum, the Consultant is expected to comply with the Eskom Engineering governance documents as listed in section 2.2.

4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
Elijah Kisaame	Chief engineer – Structures

5. REVISIONS

Date	Rev.	Compiler	Remarks
September 2024	0.1	MA Khohliso	First draft for review
October 2024	0.2	MA Khohliso	Second draft for review
September 2025	1.0	MA Khohliso	Final draft for signatures

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

MA Khohliso

7. ACKNOWLEDGEMENTS

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